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back appears a third slit on each side of the head, the first rudiment of the organ of hearing."

Or again: "At a very early stage, and while no trace of the characteristic facial structure of man is yet visible, a pair of small grooves appear before the primitive mouth cavity, the primitive nasal grooves. They are separate from the mouth cavity, which also makes its appearance as a groove-like indentation of the external skin, opening in front of the blind anterior extremity of the intestinal canal. This pair of nasal grooves, as well as the single mouth groove, are lined by the external epidermis. The two inner nasal processes or flaps arise right and left of the grooves, and opposite to these rises another groove, between the eye and nasal grooves. A plug-shaped formation projects into the nasal grooves, which is the upper-jaw process. Below the mouth groove lie the gill arches. The first of these develops into the jaw skeleton of the mouth, and is called the jaw arch. A small process first grows out from the base of the first gill arch; this is the upper-jaw process, which forms the principal part of the framework of the upper jaw. On its outer side the bone afterward unites, and in the middle portion the intermaxillary develops for the anterior portion of the frontal process. . . . The external nose is not developed until long after all the internal parts of the sense organ have been formed. It appears at the end of the second month, and grows out to form the process, but the form characteristic of man does not appear until a far later period. In most forms, the nose retains an undeveloped form. . . . The outer protective parts of the eye are merely simple folds of the skin, which appear in the third month. The inner parts originate from the inner structures of the head. . . . The entrance to the intestinal canal is the mouth opening, which is part of the intestinal system, and receives the food, which it passes on to the digestive organs. The external opening originates in a fold or groove-like incision of the external skin, and its membrane is formed from the skin. . . . The original formation of the mouth skeleton, the upper and lower jaws, is traceable to the gill arches."

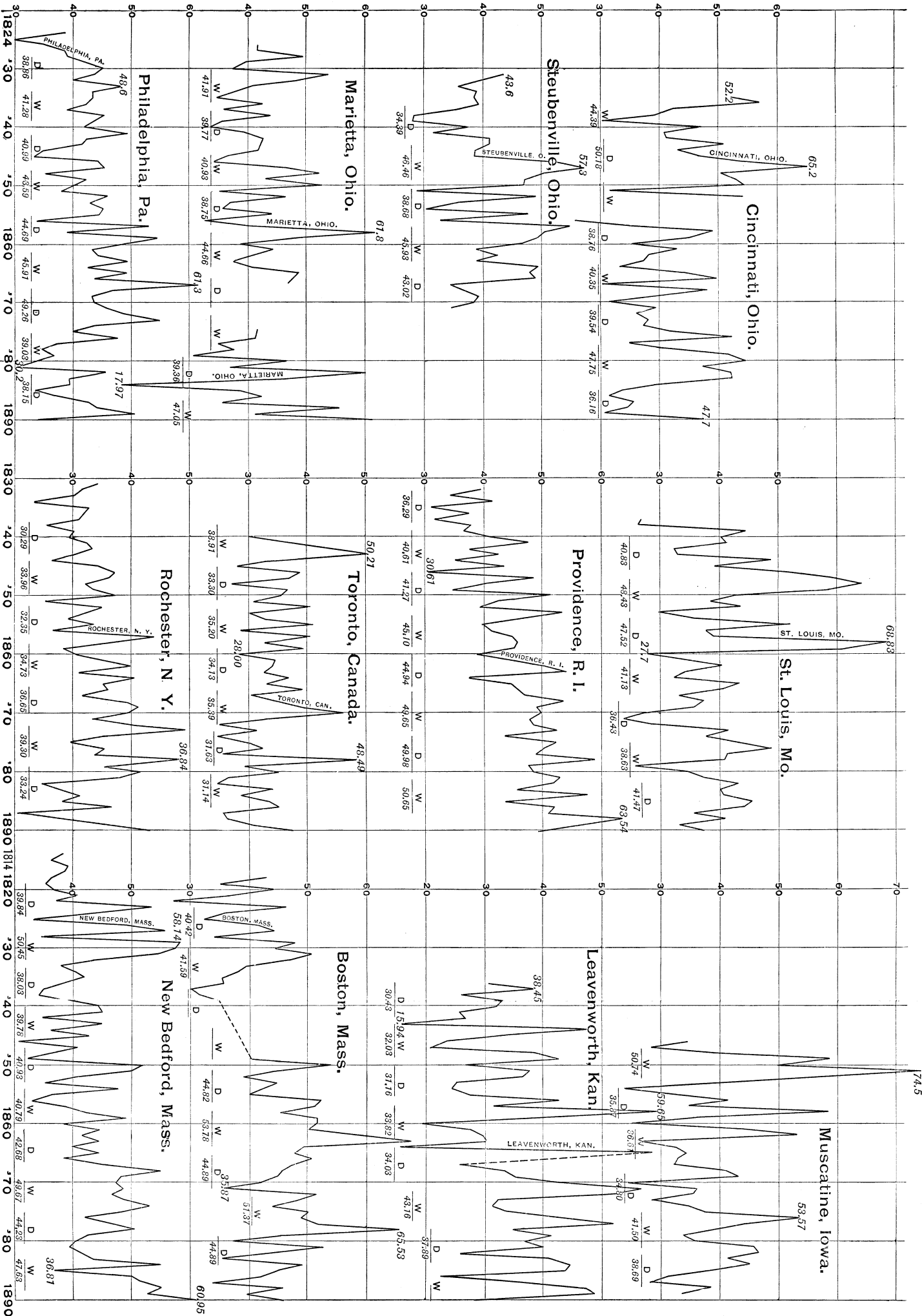
From these remarkable beginnings there has been developed the human face, with all its superadded powers of expression and physical beauty. The first crude and immature form, as seen at birth, with all its future possibilities, is produced by evolution along the same path which leads to the development of the same parts in other animals, as already noted. The resemblance to lower forms is maintained to the last stage, the last animal resemblance to disappear in the face of the human embryo being that of the apes.

We have now studied the origin and followed the evolution of the face by various paths. Surely the little evidence we have here gleaned from the great field of nature is of itself convincing that the face of man has arrived at its present perfection not by accident, not by one stroke of creative power, but by the simple, philosophical and natural methods of gradual development and evolution, in accordance with nature's laws.

IS THE RAINFALL IN KANSAS INCREASING ?

BY E. C. MURPHY, LAWRENCE.

This important and interesting question is one which has been much discussed. The writer's reason for undertaking its discussion at this time is his belief that his division of the record into periods and his treatment of the means of these periods is different from that of other writers, and answers the question asked in the title as



conclusively as it can be answered from the record. He does not claim to be the first to show that the rainfall in Kansas is increasing, or to note the fact of periodicity in rainfall. Prof. F. H. Snow and others have noted these facts.

The following table of annual rainfall of places in Kansas, taken mainly from the Fifth Biennial Report of the Kansas State Board of Agriculture, is the data that I have used. The rainfall for 1891 is computed from the observed rainfall for the first eight months and the mean monthly rainfall for the remaining four months:

TABLE NO. 1.

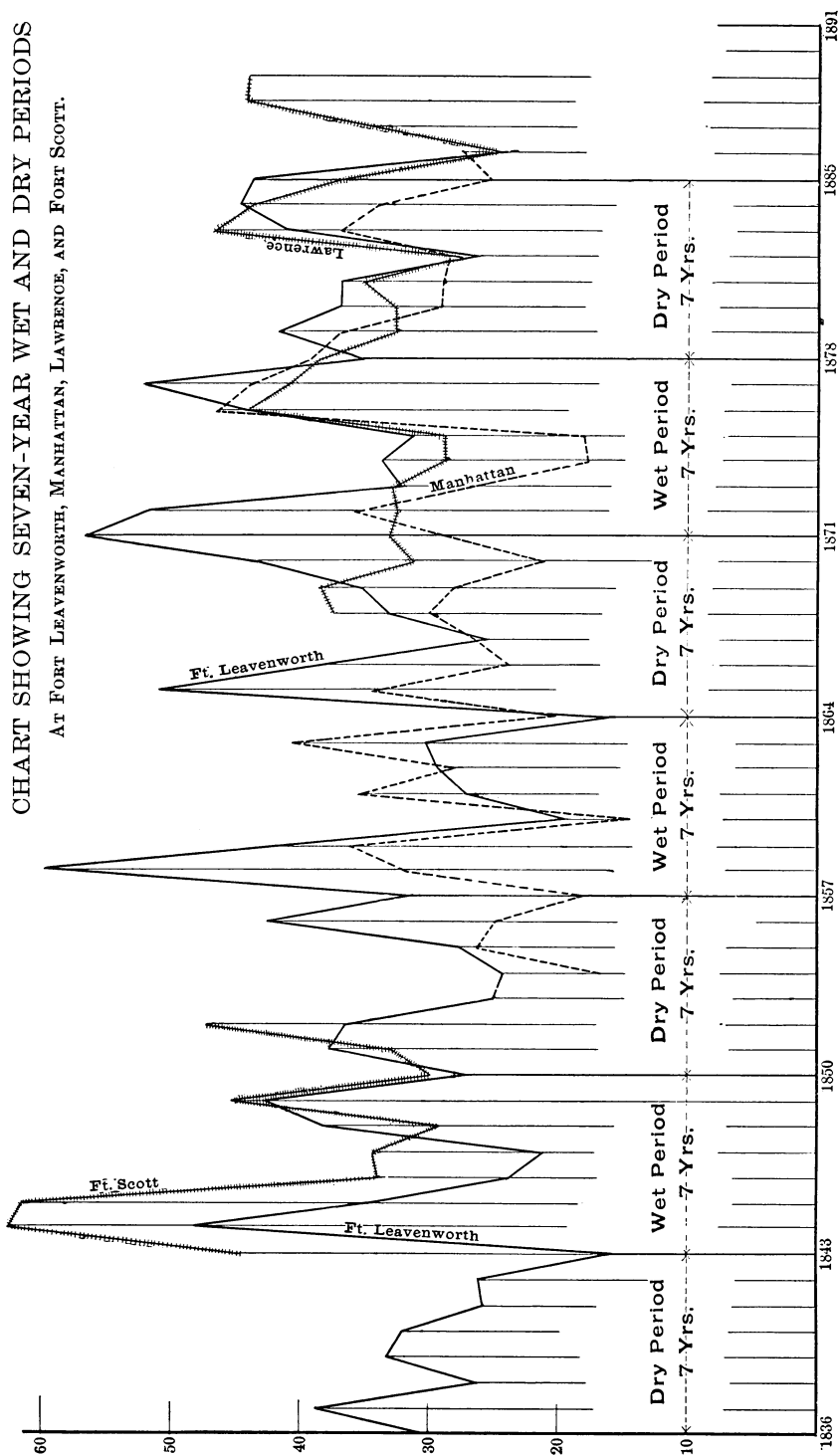
Year.	Ft. Leavenworth.	Manhattan.	Lawrence.	Ft. Scott.	Fort Larned.	Topeka (Washb'n College).	Dodge City.	Wellington.	Wallace.
1836	* 30.66								
1837	38.45								
1838	26.28								
1839	33.32								
1840	32.14								
1841	* 25.90								
1842	* 26.29								
1843	15.94			44.65					
1844	48.12			62.60					
1845	34.66			61.59					
1846	23.75			34.04					
1847	21.03			34.36					
1848	37.99			29.25					
1849	42.85			45.43					
1850	27.07			30.03					
1851	37.81			33.01					
1852	36.53			46.52					
1853	25.20								
1854	24.40	16.95							
1855	27.55	25.25							
1856	42.72	24.84							
1857	31.71	17.98							
1858	59.65	31.97							
1859	38.84	36.17							
1860	19.38	14.72							
1861	27.27	35.35							
1862	29.50	27.80							
1863	* 30.40	40.54							
1864	* 15.93	20.08							
1865	* 50.88	34.23			-36.50				
1866		23.73							
1867	* 25.72	26.50			18.35				
1868	33.18	30.08	37.48		24.70				
1869	35.31	28.22	38.51		14.11				
1870	43.18	21.19	31.32						
1871	56.75	28.62	33.23		13.64				
1872	51.61	35.78	32.63		12.97				
1873	32.16	26.16	32.94		18.23				
1874	33.81	17.61	28.87		21.73				
1875	31.26	17.96	28.87		17.80		10.69		15.85
1876	44.48	46.43	44.18		18.19		15.40		16.98
1877	52.05	43.79	41.09		30.18		27.89		16.61
1878	35.15	39.10	38.39				17.96		19.28
1879	41.55	36.86	32.68			33.14	15.43	28.96	16.56
1880	36.86	29.11	32.65			32.77	18.12	19.70	34.10
1881	39.95	28.94	35.27			26.33	33.55	39.47	8.38
1882	25.97	28.35	27.60			25.22	13.14	36.10	
1883	41.04	36.79	46.65			44.43	28.50	40.49	
1884	44.72	33.62	43.70			42.62	30.36		
1885	43.70	25.09	36.97			30.35	27.76		
1886	22.45	27.25	24.25			23.23	15.14		
1887	37.05	29.34	33.84						
1888	42.21	31.23	44.17						
1889	40.93	33.76	43.99						
1890	28.49	24.99	36.32						
1891	46.07	35.90	46.49						

* Figures obtained by interpolation.

The records of Fort Leavenworth, Manhattan and Lawrence are the only ones extending over a period of sufficient length to be of much value in answering this question.

The accompanying chart shows the annual rainfall line drawn to scale for these

CHART SHOWING SEVEN-YEAR WET AND DRY PERIODS AT FORT LEAVENWORTH, MANHATTAN, LAWRENCE, AND FORT SCOTT.



three places, and also for Fort Scott. It shows also the division into seven-year dry and seven-year wet periods.

By a dry period we do not mean that each year of it is a dry year. The rainfall of some years, in a dry period, may be greater than that in some years of a wet period. One period is dry compared with another when the mean rainfall of the first period is less than that of the second.

Beginning with the Fort Leavenworth line, we see from it that from 1836 to 1842 there is a seven-year dry period, the mean rainfall for this period being 30.43 inches. From 1843 to 1849 there is a wet period, the mean rainfall for this period being 32.03 inches. Table No. 2 gives the results in tabular form.

TABLE No. 2.

Years.	FORT LEAVENWORTH.			MANHATTAN.			LAWRENCE.	
	Period.	Mean.	Mean.	Period.	Mean.	Mean.	Period.	Mean.
1836-'42.....	1st D....	30.43	30.43	.....	.....	.....	.....	.....
1843-'49.....	2d W....	32.03	32.03	.....	.....	.....	.....	.....
1850-'56.....	3d D....	31.16	31.16	.....	.....	.....	.....	.....
1857-'63.....	4th W....	33.82	33.82	4th.....	29.22	29.22	.....	.....
1864-'70.....	5th D....	34.03	33.03	5th.....	26.29	26.29	.....	.....
1871-'77.....	6th W....	43.16	34.16	6th.....	30.91	29.41	6th.....	34.54
1878-'84.....	7th D....	37.89	33.64	7th.....	33.25	27.00	7th.....	36.71
1885-'91.....	8th W....	37.27	37.27	8th.....	29.65	29.65	8th.....	38.00

Examining the means in column three, table No. 2, we see that those of the fifth, sixth and seventh periods are larger than those preceding them, indicating a large increase in the rainfall. We will subtract from the mean of the fifth period 1 inch, from the mean of the sixth 9 inches, and from the mean of the seventh $4\frac{1}{2}$ inches, in order partly to eliminate this large increase. Column four gives the means when thus reduced. Examining the means in this column, we see that they are alternately wet and dry, and that each dry mean is wetter than the preceding dry mean, and each wet mean is wetter than the preceding wet mean. Hence, after taking away 100 inches of rainfall from this record, there is left a gradual increase during the whole 56 years covered by the record.

Consider next the Manhattan line: The record of rainfall at this place begins in 1854. This is not the beginning of a period; the first full period of this record (the fourth period of the Fort Leavenworth record) begins in 1857. Column six, table No. 2, gives the means for this place. We subtract $1\frac{1}{2}$ inches from the sixth mean, and $6\frac{1}{2}$ inches from the seventh mean, giving the means in column seven. Examining the means in this column, we find that they are alternately wet and dry, and each dry mean is wetter than the preceding dry mean, and each wet mean is wetter than the preceding wet mean. Hence, after taking away $54\frac{1}{2}$ inches of rainfall from this record, there is left a gradual increase during the whole 35 years covered by the record.

Examining the three Lawrence means, in column nine, table No. 2, we see that the eighth is larger than the seventh, the seventh larger than the sixth. Hence, there has been a gradual increase in rainfall at this place during the 21 years covered by the record.

It should be remembered that the writer does not claim that the rainfall has always been increasing in Kansas, or that it will continue to increase in the future. His conclusions apply only to these three places for the time covered by the record.